

# HEXAN II by



## PORTABLE THREE-PHASE PROTECTION RELAY TEST SET

**Current (25 A/ph) & Voltage (300 V/ph)**

**Extremely versatile**

**Very user friendly**

**Run from PC OR Custom interface**

**Modular & Configurable**



**HEXAN II** uses Digital Signal Processing to combine the accuracy necessary for testing Electronic relays (Static or Digital) with the power needed to test Electromagnetic relays by secondary injection.

**HEXAN II** is operated in one of two modes :

- **Manually**, using the **MCM Custom Interface** which displays and sets the electrical parameters (simple & complex voltages, currents, phases, frequency...) which define a healthy or faulty network. A scrolling menu gives access to the the various test modes : shunt, re-closer, generator protection, and neutral offset.

**By PC**, using the user-friendly MANUSOFT control software which presents the operator with a virtual manual control panel as for a typical test set, with potentiometers for control as well as advanced injection tools, Fresnel diagram display and the symmetrical components.

### HEXAN test software modules :

<b>AH-PDMI</b>	Minimum Impedance Relay (Railway application)
<b>AH-PRODI</b>	Distance Protection (Electrical transmission)
<b>AH-CTF</b>	Generator Protection
<b>AH-SC</b>	Synchro coupler
<b>AH-MITI</b>	Overcurrent protection (constant & inverse time relays)
<b>AH-COMTRADE</b>	Transient re-injection
<b>AH-SMARTEST</b>	Automatic relay tester & state sequencer
<b>AH-RH7T</b>	Harmonic generator

# SPECIFICATIONS

## Amplifiers

Protection against overload & short circuit on the voltage & current outputs. All connections for amplifier outputs are 4 mm banana plug

### Voltages

Amplifiers **13 V/130 V** for 6X0 models

3x Ph-N **3x 0...130V**

1x Ph-Ph **1x 0...260 V**

Puissance : **3x 60 VA at 130 V**

Résolution : **400  $\mu$ V at 13V ; 4 mV at 130 V**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

Amplifiers **130 V/260 V** for 6X1 models

3x Ph-N **3x 0...260 V**

1x Ph-Ph **1x 0...520 V**

Puissance : **3x 60 VA at 260 V**

Résolution : **4 mV at 130 V ; 8 mV at 260 V**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

Amplifiers **150 V/300 V** for 6X2 models

3x Ph-N **3x 0...300 V**

1x Ph-Ph **1x 0...600 V**

Puissance : **3x 70 VA at 300 V**

Résolution : **5 mV at 150 V ; 9 mV at 300 V**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

### Currents

Amplifiers **15 A 40 VA** for 60X models

3x Ph-N **3x 0...15 A**

1x Ph-N **1x 0...45 A**

Puissance : **3x 40 VA at 15 A**

Résolution : **460  $\mu$ A**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

Amplifiers **15 A 110 VA** for 65X models

3x Ph-N **3x 0...15 A**

1x Ph-N **1x 0...45 A**

Puissance : **3x 110 VA at 15 A**

Résolution : **460  $\mu$ A**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

Amplifiers **5A / 25 A 175 VA** for 61X models

3x Ph-N **3x 0...25 A**

1x Ph-N **1x 0...75 A**

Puissance : **3x 175 VA at 25 A**

Résolution : **150 $\mu$ A à 5A ; 760  $\mu$ A à 25A**

Précision : **0.1 %**

Distorsion : **0.1 % THD\***

### EMC

The product complies with 2004/108/CE on electromagnetic compatibility

### Safety

The product complies with low voltage 2006/95/CE and in particular NF EN 61010-1

\* THD : values at full load (100 % of range) and at 45-65 Hz

## Environmental conditions

Operating temperature : 0°C—40°C

Storage temperature : -25°C—+70°C

Relative humidity : 10 to 80% without condensation

Pollution degree 2 ; Installation category II

## Software

Suitable for Windows® 2000/XP/VISTA

Connection USB (integrated without converter) or RS232

## Case

HEXAN Type II

Aluminium, with transport handle

Dimensions : L=448, P=320, H=180,5 mm

Weight : 13 kg

## Power supply

180-264 Vac, 50/60 Hz

90-132/180-264 Vac, 47 à 63 Hz (option)

Power : 900 VA Maximum

2100 VA Maximum for 25 A models

IEC 320 plug

## Timer inputs

Numbers : 4

All inputs are isolated

Sensing : Voltage free (dry) contact or voltage AC/DC up to 250V

Connection : 4 mm security banana plug

Precision : 0.02 % of value +1 ms

Resolution : 1 ms

## Logic Outputs

Number : 3

Dry contact (NO/NC)

Connection : 4 mm security banana plug

## Frequency

Range : 0.1...500 Hz

Resolution : 500  $\mu$ Hz

Precision :  $\pm$  1 mHz à 50 Hz

DC voltage or current : all amplifiers are able to generate DC outputs up to their maximum ranges

# MANUSOFT

## Control Software

Software is available in English and French.

### Manusoft

Manusoft is aimed at all types of user since it requires no computing knowledge. It is an easy to use manual interface that allows you to rapidly test your protection devices. You can access all the settings with a few mouse clicks.

The electrical values are set using virtual potentiometers either using the mouse, by moving vectors in a Fresnel diagram or by typing in the values with the keyboard. There are a number of tools to help you make your tests: display and calculation of the symmetrical components, Fresnel diagrams, 4-channel timer with on-screen display, inter-channel timing, balanced networks, tools for creating two-phase and zero sequence faults, and eight memories to hold fault conditions. The tests are stored as files which can be used to produce test reports.

### Use For

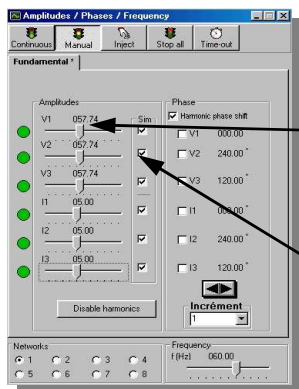
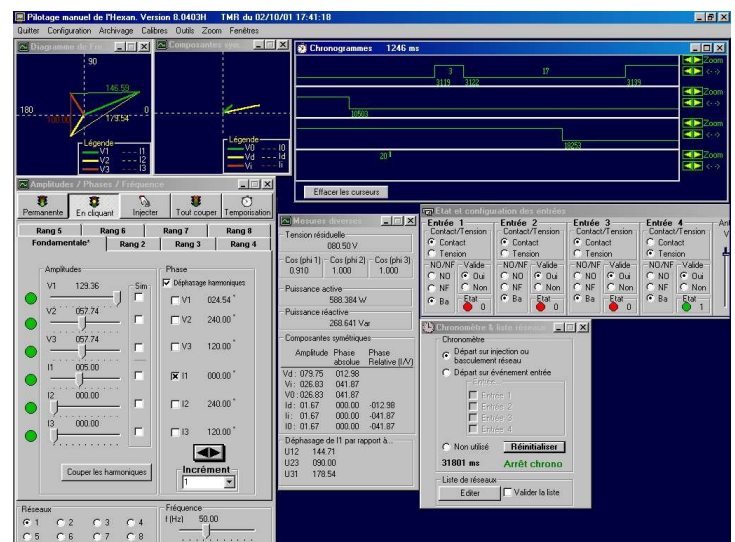
Find threshold and response time measurement for relays type :

- Overcurrent
- Voltage
- Power (single and three phases)

Fail network :

- Phase-earth
- Phase-Phase
- Three phases
- Simple or with reclosing

The precision and quality of signals outputs

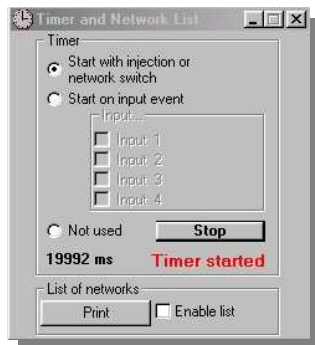


...Adjust your networks easily – with the mouse for coarse adjustment, the arrow keys for fine adjustment and you can even enter a value from the keyboard.

Lock your generators to change simultaneously the network value...

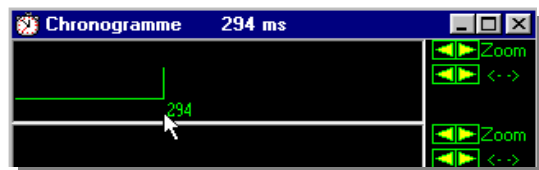
# MANUSOFT (continued)

## Time measurement



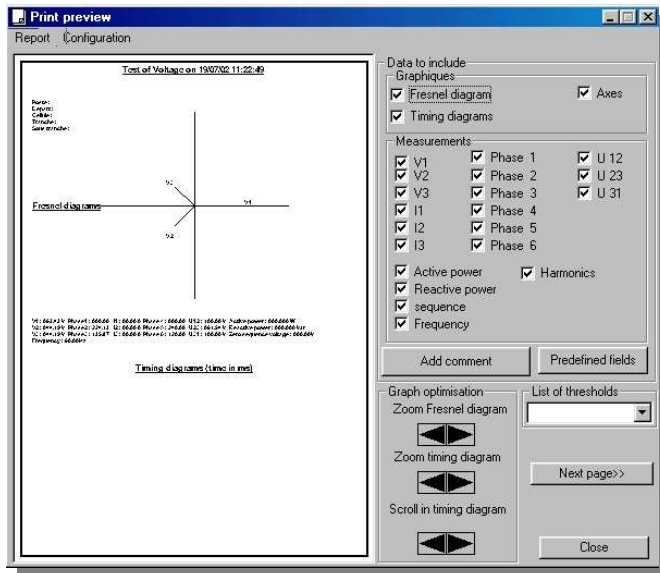
switch a good network to a failing network then ...

...the response time of your protection device appears on your screen !



You can also use the four timer inputs of the **HEXAN** to measure the difference in response time of a circuit breakers poles, or if there is a reclosing cycle, the long and short cycles.

## Test reports



When your test has finished you can save your settings in order to produce a test report.

This report allows you to keep a written trace of the threshold values, reaction time and any comments you want to make.

# Application ref. AH-CTF

## TESTING AUTONOMOUS SUPPLY RELAYS

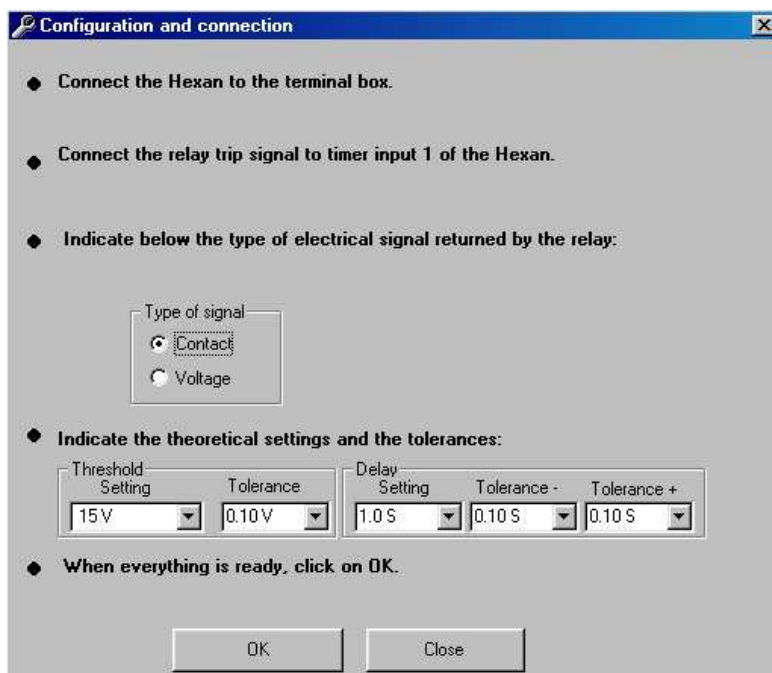
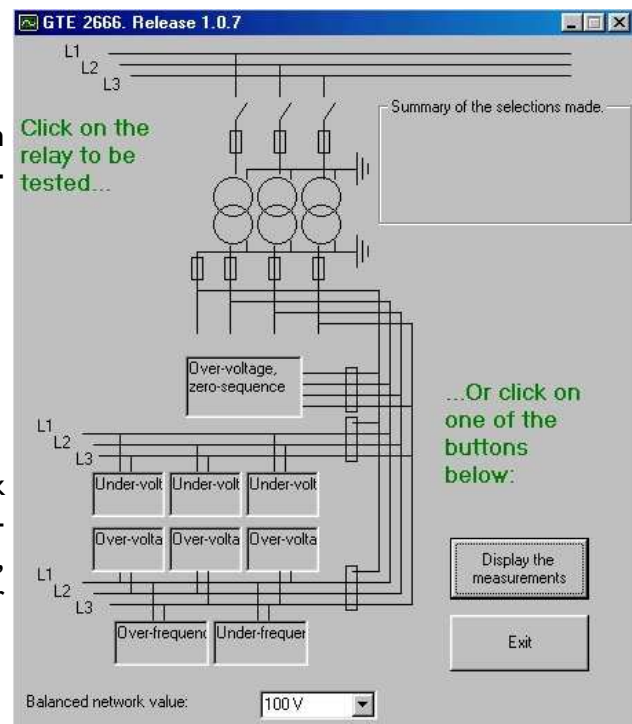
This application allows the testing of over and under voltage relays, over and under frequency relays and zero sequence over-voltage relays.

This application has two test modes:

- ⇒ **Manual**
- ⇒ **Automatic and optimises search based on the values set in the control window**

Principle:

Generation of a three-phase voltage network which, as a function of the selected relay under test and the theoretical search results, will change its complex voltage, frequency or phase angles.



Description:

A selection window for choosing the relay to test  
A control window for setting the search values

# Application ref. : **AH-MITI**

## TESTING CURRENT CONSTANT TIME AND INVERSE TIME RELAYS

With the MITI application you can test and save results for over-current relays (one, two and three phase faults). The relay can have fixed or independent time characteristics.

This application has two test :

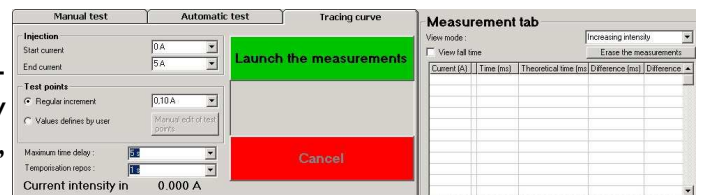
- ⇒ **Manual** – uses the two sliders: I for the pass network and the other for the fail network.
- ⇒ **Automatic** – operates with the parameters set in the control window and finds the threshold with one mouse click.

### Principle :

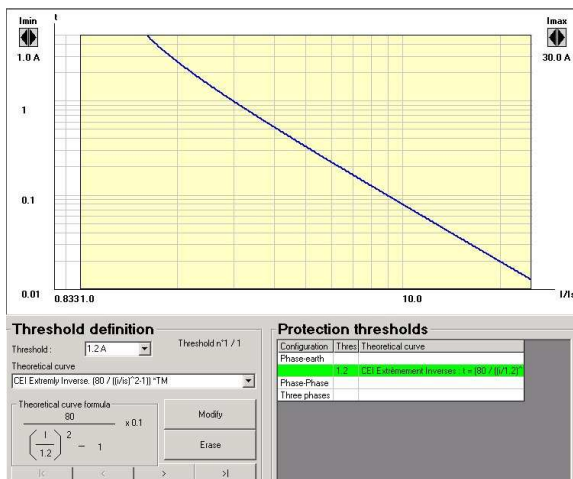
Generation of a three-phase current network which, as a function of the selected relay under test and the theoretical search results, will

- Find the threshold using a linear or binary search.
- Measure the relay reaction time.
- Measure the hysteresis and the tripping time.
- Compare the inverse, very inverse, extreme inverse, ultra inverse and RI time curves.

The test results and the theoretical values in the tree structure of the new server (organisation of a sub-station and protection relays).



### Description :



- Menu for choosing fault type.
- Control window for setting the search values.
- Window with two sliders for adjusting the network between pass and fail.
- Logarithmic grid for displaying inverse time characteristics...

# Application ref. : **AH-SC**

## TESTING SYNCHRONISATION RELAYS

The software for easily testing synchronisation relays using the **POW-HEX** computer controlled injection system.

This application has two test modes :

- ⇒ **Manual** – the user chooses faster or slower with the mouse,
- ⇒ **Automatic** – operates with the parameters set in the control window and the relay control signals.

### Principle :

Generation of two independent voltage vectors :

- a fixed vector V1 of frequency F1 corresponding to the reference network,
- a mobile vector V2 of frequency F2 representing the generator to synchronise.

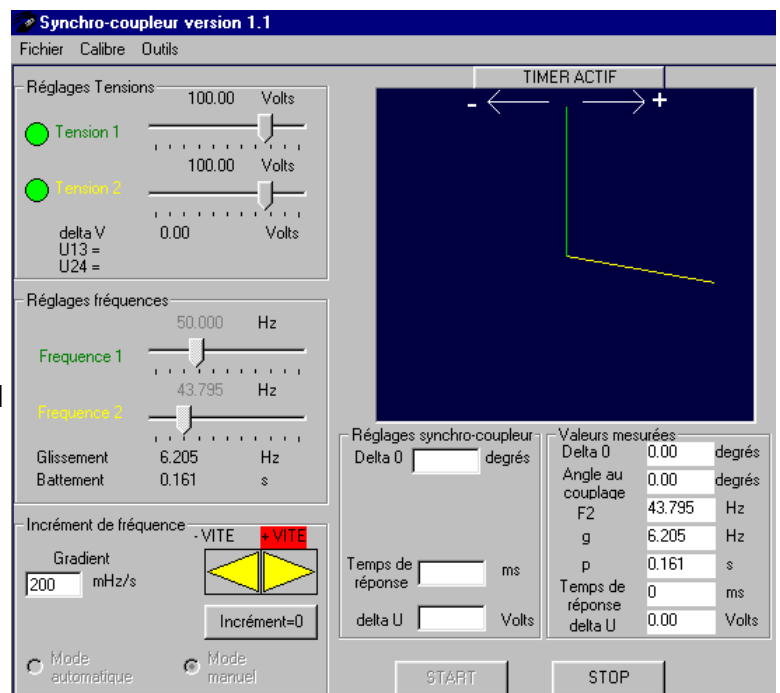
The various parameters for the tests are programmed in the control window :

- Voltages V1 and V2: adjustable from 0 to range maximum,
- Frequencies 1 and 2: adjustable from 5 à 100 Hz,
- Frequency gradient: adjustable from 0 to 4000 mHz.

Whatever the selected test mode the software will supply the following information after synchronisation :

- The angle  $\Delta 0$  in degrees,
- The frequency of the mobile network F2 in Hz,
- The voltage difference  $\Delta U$  in Volts,
- The beat time p in seconds,
- The chain time in ms.

The tests can be saved into files and used to produce test reports.



# Application ref. AH-PDMI

The application briefly described in this section is for impedance relays of the PDZI type. You enter the settings, configure the search mode for the points, enter the accuracy required and the margins around the theoretical values.

When everything has been configured, you can run the test. The points found are displayed in a graph window. An algorithm will calculate the straight lines from the points. The program allows you to compare the theoretical parallelogram with the actual points recorded during the test and to measure the distances (in  $\Omega$ ) which separate them.

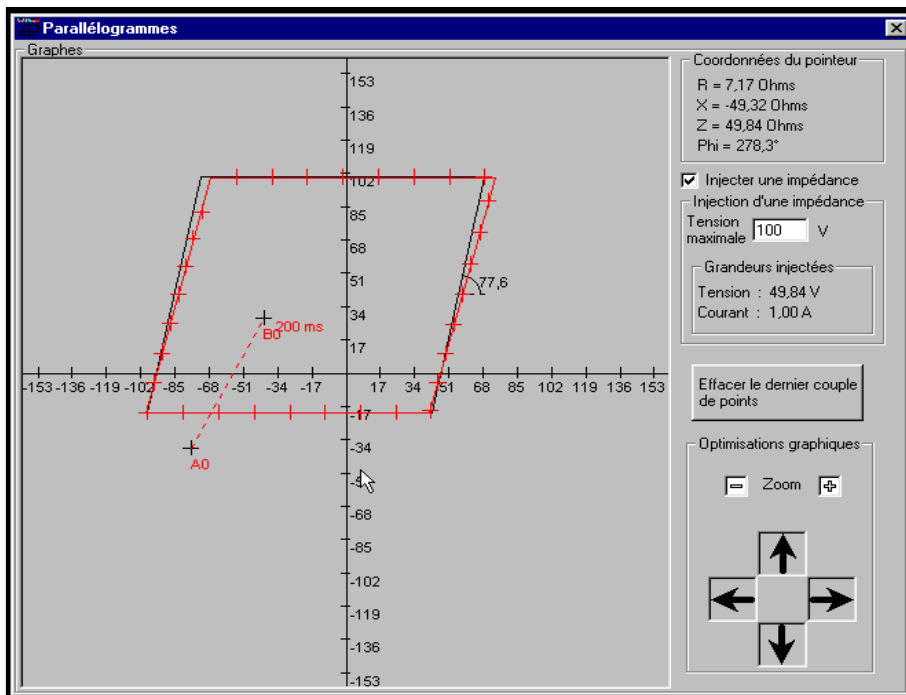


which separate them.

You can ask the HEXAN to inject a current or voltage corresponding to the impedance under the mouse pointer, and

thus manually check the way the relay is responding. You can use this tool to make several response time measurements by changing from one point to another. You also have the possibility to save all the settings, the measured parallelogram and the time measurements.

This overview has not allowed us to explain other useful tools such as the zoom, movements and contextual menus.





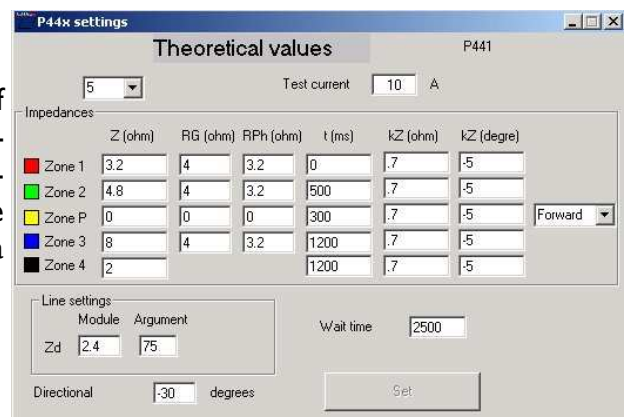
# Application ref. : **AH-PRODI**

## Tests distance relays and minimum impedance relays

PRODI provides an easy to use solution for testing distance relays and minimum impedance relays. The faults to be simulated can be chosen by tabs and the tests carried out for each fault are automatically saved during the test. The following line faults are configured :

- **Single phase faults**
- **Fault between phases**
- **Three-phase faults**

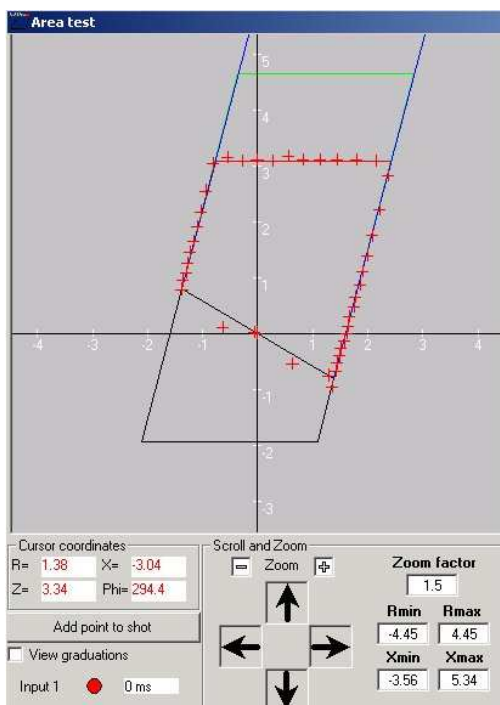
Input grids are provided for the most popular types of relay to guide the user during entry of the line parameters. You also have the possibility of entering the parameters for any other type of relay using the Define Relay menu. You also have the possibility of creating a parameter for a distance relay.



The application has several test modes :

- **Direct injection in the impedance path (R,X)**

The values on the outputs of the Hexan track the mouse pointer position as a function of the default parameter. This ability is useful for manually characterising the relay or for quickly measuring the tripping time of the zones.

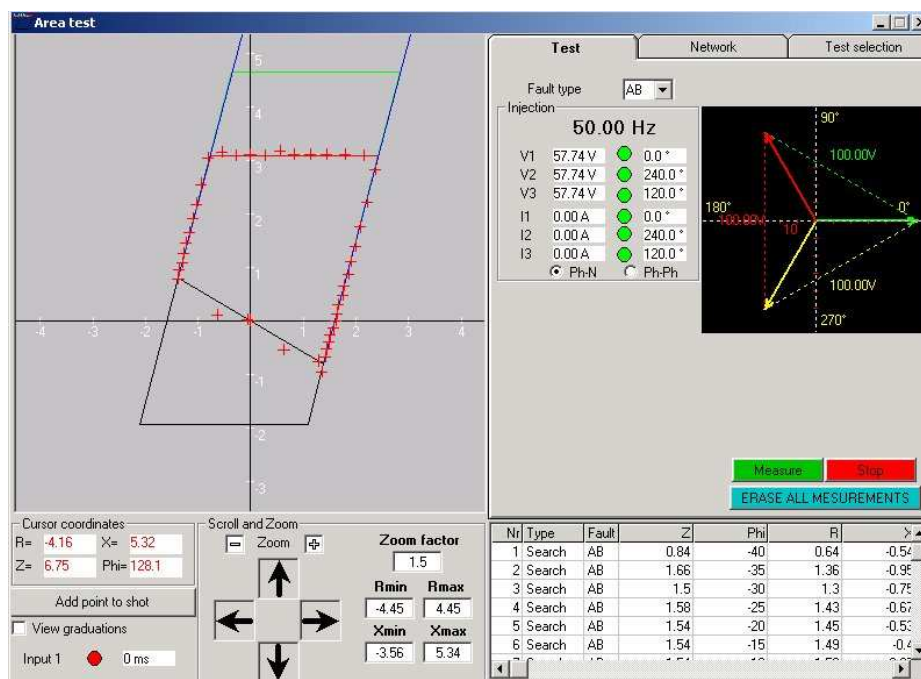
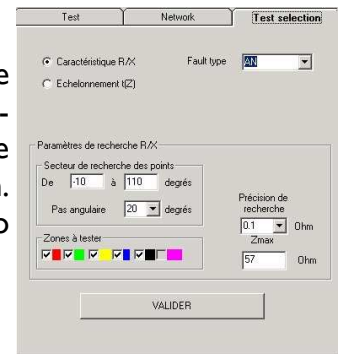


.../...

# Application ref. : AH-PRODI

- **Automated testing**

Distance relay testing can be long and fastidious so automating some or the stages can speed up testing and make it easier. The zone limits, time measurements along the straight part of the impedance path and the impedance tripping are all automated and follow a time-optimised search algorithm. Many options for the searches and time measurements can be set prior to testing.



- **Test sequencing**

In order to speed up the testing process, and to improve tracability, it is possible to set a sequence of tests and for the user to run them as required. These sequences can, for example, cover the testing of the rearming mechanism or time measurements with or without status recording. Once a sequence has been recorded it can be saved in SMARTTEST format (state machine) and can be changed at will (injection time, successful/unsuccessful rearming, etc). The PRODI application thus serves as an input screen for SMARTTEST.

# Application ref. : AH-SMART

## Automated testing of relays et Statesequencer

SMARTEST is an application for the POWHEX that allows the generation of networks for a given time along with signals on the output contacts and to capture logic signals on the timer inputs.. A spreadsheet type interface provides an easy to use method for entering the parameters.

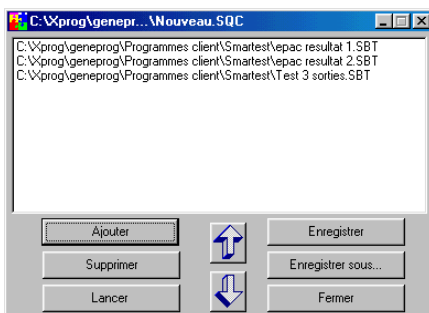
### State sequencer

	Expected graphs														Actual graphs													
	Etat 1		Etat 2		Etat 3		Etat 4		Etat 5		Etat 6		Etat 7		Etat 1		Etat 2		Etat 3		Etat 4		Etat 5		Etat 6		Etat 7	
V1	57.74V	0.00°	0V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°	57.74V	0.00°
V2	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°	57.74V	240°
I1	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°	57.74V	120°
I2	0A	0.00°	5A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°	0A	0.00°
I3	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°	0A	240°
F	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°	0A	120°
F	50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz		50Hz	
Unité/Divise																												
HMI																												
Chronométr	Départ		Start		Start		Start		Start		Start		Start		Start		Start		Start		Start		Start		Start		Start	
Durée (ms)	11000ms		200ms		9000ms		200ms		5000ms		200ms		10000ms		200ms		10000ms		200ms		10000ms		200ms		10000ms		200ms	
Mode	Step		Step		Step		Step		Step		Step		Step		Step		Step		Step		Step		Step		Step		Step	
Transition	End of dural		Input 1		End of dural		Input 1		End of dural		Input 1		End of dural		Input 1		End of dural		Input 1		End of dural		Input 1		End of dural		Input 1	
Erreur 1																												
Erreur 2																												
Erreur 3																												
Erreur 4																												
Sortie 1																												
Sortie 2																												
Sortie 3																												

A state is the definition of a complete three phase network (three currents and three voltages) and includes amplitudes, phases and frequencies. With the notion of state there is :

- Modes of change between states : **ramp or step.**
- Transition criteria : **timer, on change of a signal input, on keyboard entry.**

Classically, relay testing requires three states: pre-fault, fault and post fault. A state sequencer is therefore perfectly adapted to this type of test, However, certain types of protection relays require the injection of several fault states to be properly tested. SMARTEST can generate up to 52 independent states for each file. The definition of these states is therefore the starting point for your test sequence.



### Automated relay testing

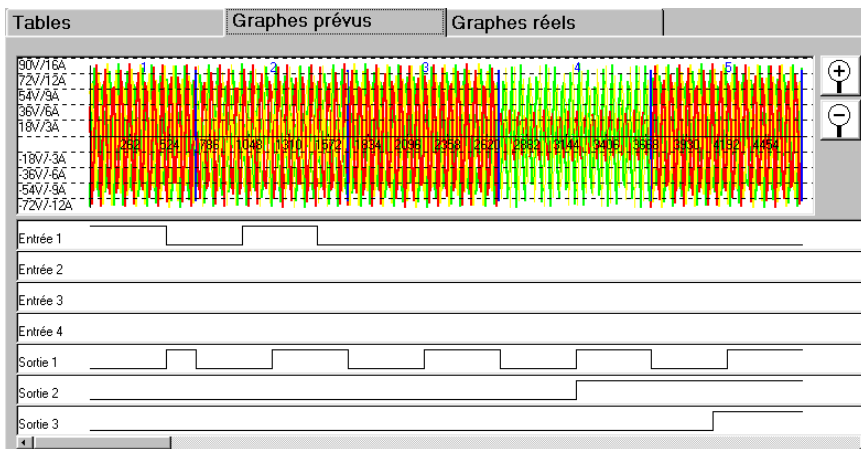
Files can themselves be sequenced. This simplifies repeatability tests and also tests of automatic rearmament This way tests for the all relays in a cabinet can be pre-programmed and executed on site from a single sequence file.

### Simplified injections

A number of tools simplify input such as balanced networks, resetting, copying of previously programmed networks. SMARTEST also supports the input of values :

- **As a percentage of a nominal value**
- **At the primary**
- **Directly as a function of the symmetrical components**

# Application ref. : **AH-SMART** (continued)



## Result analysis

The test results are available in several forms :

Graphically by timing diagram, or in tabular format.

Results can be archived using the COTEL archive server. By connecting to this server ensure you have result traceability. Exporting the results to a spreadsheet is very easy since the results are in a tabular format.

mat.

The screenshot shows the 'Niveaux de l'entrée 1' dialog box. It contains two tables: 'Niveaux prévus' and 'Niveaux réels'. The 'Niveaux prévus' table has columns for 'Instant (ms)', 'Précision (ms)', 'Niveau', and 't relatif (ms)'. The 'Niveaux réels' table has columns for 't mesuré (ms)', 'Niveau mesuré', and 't relatif (ms)'. Below the tables are buttons for 'Ajouter', 'Editer', 'Supprimer', 'OK', and 'Annuler'. There are also radio buttons for 'Contact' and 'Tension' under 'Configuration de l'entrée'.

Instant (ms)	Précision (ms)	Niveau	t relatif (ms)
0	0	1	0
500	0	0	500
1000	0	1	1000
1500	0	0	1500

t mesuré (ms)	Niveau mesuré	t relatif (ms)
0	1	0
501	0	501
1003	1	1003
1503	0	1503
2005	1	2005
2505	0	2505
3006	1	3006

Entry of expected values can be performed before or after the test. A comparison between the settings and the expected results is proposed at the end of the test. The timing diagram displays response times in popups when you move the mouse cursor. You can also zoom and scroll in time.

SMARTTEST is an automation program that sits between PROSOFT (programming language) and Manusoft (manual relay testing), SMARTTEST is the tool you need for :

- **Periodic relay tests**
- **Preparation of tests prior to going on-site**
- **Automated test procedures**
- **Testing automatic rearming**
- **Testing relays with several thresholds**
- **Testing inverse time current relays**
- **Testing motor start relays**
- **Testing relays with manual rearming**
- **Testing relays with accelerating time characteristics**

And many other applications.

# HEXAN Manual Interface

## MCM

The Manual Control Module (MCM) is an interface to the HEXAN that allows you to control the system without using a PC. This device can be used in place of a portable PC with no internal modification to the test set and can therefore be used on any test sets currently in service. The MCM is designed to meet the needs of users for standard tests. Its ease of use coupled with short set-up times and a multitude of pre-programmed functions make it a useful addition to the HEXAN for systematic testing of protection relays.

### Description :

- Aluminium case: **243/145/52 mm**,
- Weight: **1 kg**.

### Power supply :

- Directly from the HEXAN



### Main functions of injection control :

The functions of Manusoft that simplify testing of coupling cabinets are implemented in the MCM :

- Control of the three voltages and three currents of the HEXAN. Each value is controlled by an up and down button,
- Frequency 40 to 70 Hz on the voltages and currents,
- Phase shift of the voltages from the currents –  $180^{\circ}/+180^{\circ}$ ,
- Control of two networks: Pass and Fail,
- Injection mode direct or step by step,
- Simultaneous variation of the three voltages and three currents by linking the controls,
- Moving the neutral point along V1, V2 or V3,
- Variation of the phase-to-phase voltage: U12, U23, U13,
- Differential current mode,
- Vector jump,
- Programming of network sequences.

### Timer section and digital injection control :

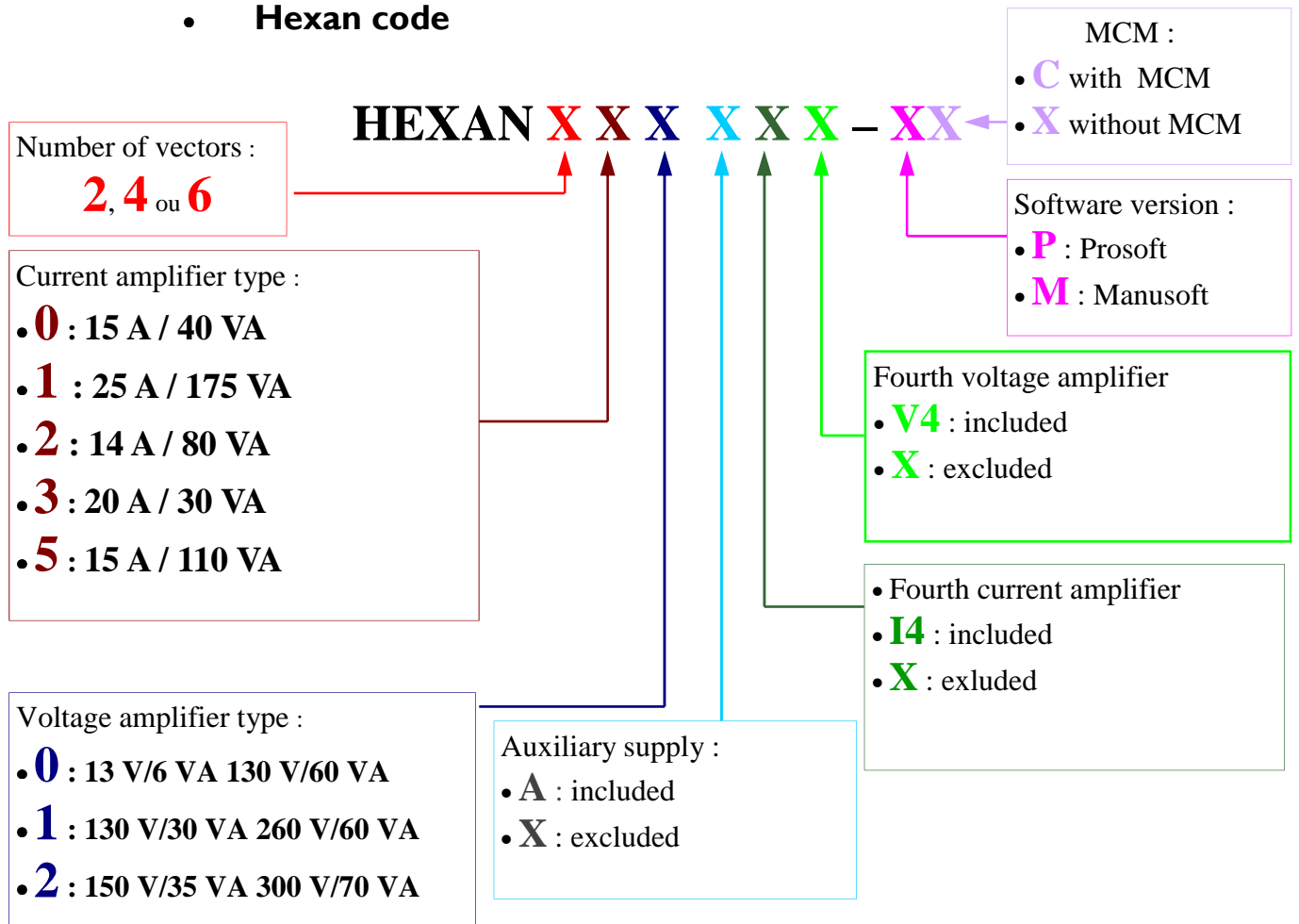
- Backlit alphanumeric LCD display: **4 lines of 20 characters** for all injection parameters.
- Resolution : **1 ms**
- Range : **0-199.999 s**
- Timer start on injection or external event,
- Cycle measurement (e.g. rearming),
- Programming of volt-free contact in the HEXAN,
- Four independent timer inputs configurable to contact or voltage.

### Range resolution :

- 100 mV for voltages
- 10 mA for currents
- 10 mHz for frequency generator
- $0.1^{\circ}$  for phase shifter.

# Order Code

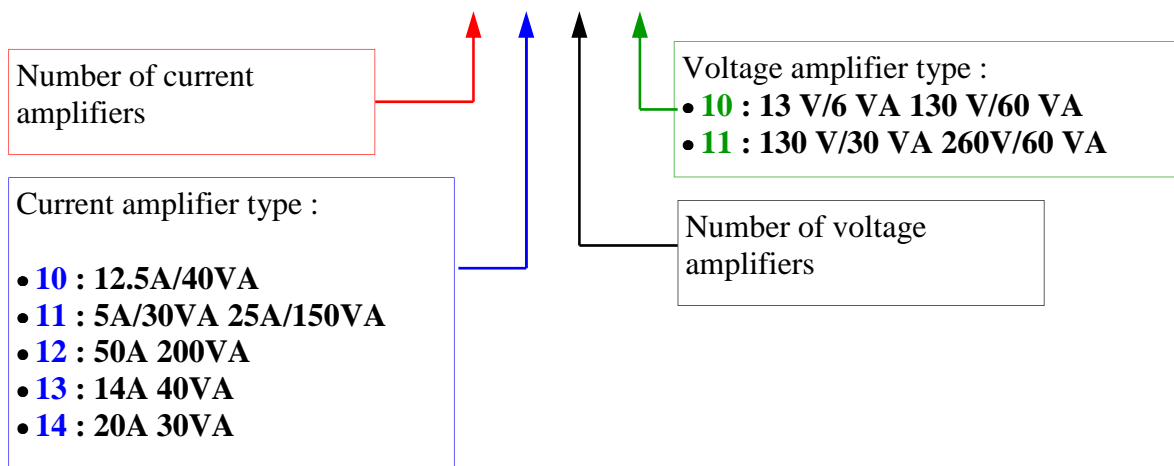
## Hexan code



- Auxiliary DC Voltage supply : Ouput 24 V, 48 V and 127 V.
- The manual box driver drives HEXAN without PC, please contact us for more details.

**External module :** The external modules are designed for specific applications (Power need, Precision ...) please contact us for a configuration best adapted to your requirements.

## Hexan External Module X XX X XX







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